SHARP Service Manual

CCTV Camera

MODEL IT-31CZ

SPECIFICATIONS

Resolution	
Video Output	VS 1.4Vp-p, 75 ohm
Scanning System	Random Interlace System
Horizontal Scanning Frequency	15,750Hz
Vertical Scanning Frequency	50Hz or 60Hz Power Supply Synchronization Type
Pick-up Tube	21/32" Vidicon (V-8844)
Power Source	110V, 120V, 220V, 240V (±10%) 50 or 60Hz AC (Factory Setting for Every Country)
Power Consumption	10W
Ambient Operation Temperature	14°F ~ 113°F
Image Illumination	More than 20 Lux
Dimensions	Approx. 5"(H) x 2-3/4"(W) x 9"(D)
Weight	Approx. 4.6 lbs.

SEMICONDUCTOR COMPLEMENT

Q101	2SK19	1st Video Amp.
Q102	2SC454	2nd Video Amp.
Q103	2SC454	3rd Video Amp.
Q104	2SC454	Video Clamper
Q105	2SC454	4th Video Amp.
Q106	2SC454	Sync. Insertion
Q107	2SC454	Video Output
Q108	2SC154B	Automatic Level Control
Q301	2SC454	Form Shaping
Q302	2SC281	Vertical Oscillation
Q303	2SC454	Vertical Amp.
Q304	2SC708	Vertical Output
Q401	2SC281	Horizontal Oscillation
Q402	2SC708	Horizontal Output
Q501	2SC454	Vertical Blanking Amp.
Q502	2SC454	Horizontal Blanking Amp.
Q503	2SC454	Blanking Mixer & Output
Q601	2SC680	Power Regulator
Q602	2SC281	Power Regulator
Q603	2SC458	Power Regulator
D101	1N34A	Horizontal Sync. Signal Input
D102	1N34A	Vertical Sync. Signal Input
D103, D104	1N34A	ALC Voltage Detection
D301	1N34A	Vertical Sync. Signal Clipper
D302	1N34A	Damping
D501	1N34A	Sync. Signal Insertion
SR401	SI-RECT-98	Damper
SR601, SR602	SI-RECT-2	Power Rectifier
SR603	SI-RECT-142	+300V Rectifier
SR604	SI-RECT-142	-100V Rectifier
SR605, SR606, SR607	SI-RECT-144	+100V Zener
SR608	SI-RECT-88	Zener

SHARP CORPORATION OSAKA, JAPAN

21/32 VIDICON RATING (8844, 8823 or 20PE13)

21/32″ VIDICON RATING (8844 or 8823 or 20PE13)

* Cathode: Indirect-heated
* Heater Voltage: 6.3 V
* Heater Current: 95mA
* Focusing System: Electromagnetic Focus
* Deflection System: Electromagnetic Deflection
* Photoconductive Surface:
  - Active square: Maximum Diagonal Length: 14/32″
  - Aspect Ratio: 3 : 4
* Weight: 25 g

① Cathode
② 4th Grid
③ Heater
④ Heater
⑤ 1st Grid
⑥ 2nd Grid
⑦ 3rd Grid
Ⓢ Signal Electrode

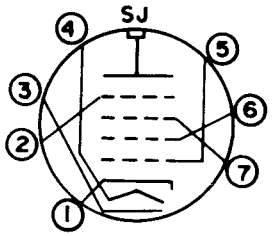


Figure 1 Pin Connection

INSTALLATION ANGLE:
The direction of horizontal scanning should be paralleled to the plane made by tube oxis and Pin 4.

PICK-UP TUBE

The electron tube that converts the optical image focused by lense on the face plate of the tube into electric signal is called "Image Picture Tube", and has the most important function in TV camera.
There are many kinds of "Pick-up Tube" by their operational mechanism, that is, Iconoscope, Image Orthicon, Vidicon, Planvicon and etc., however, the Vidicon is most suitable for small-sized and light-weighted CCTV camera, therefore, 21/32″ Vidicon is adopted in the camera part of IT-31CZ.

The following figures are the outer appearance and structure of 21/32″ Vidicon.

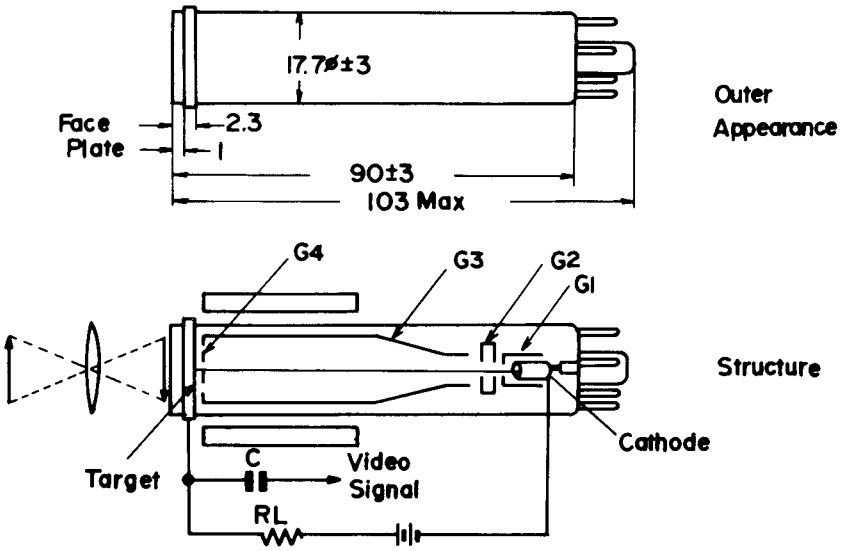


Figure 2 Outer appearance and Structure

There is a plain glass at the one side of glass tube having 21/32" (approx. 17 m/m) diagonal, and the optical image is focused on the transparent conductive film at the inner side of plain glass and this film is connected with the metal ring that joints glass plate and tube, and works as an electrode to take out the signals. On the surface of this transparent conductive film, the most important film of photoconductive material is vapor-spattered.

Electron gun is installed against photoconductive film and is composed of cathode and four grids, No.1 to No.4. The electron current generated from cathode flows through G1, is accelerated at G2 and focused by G3, G4 and focus coil, then its focus is made on the photoconductive plane.

To operate the Vidicon, the following attachments are needed.

1. FOCUS COIL - To focus the electron beam emitted from electron gun on the photoconductive plane.
2. TWO PAIRS OF DEFLECTION YOKE
   To scan the electron beam in both vertical and horizontal directions.
3. ALIGNMENT MAGNET
   To align the electron beam in the FOCUSING MAGNETIC FIELD.

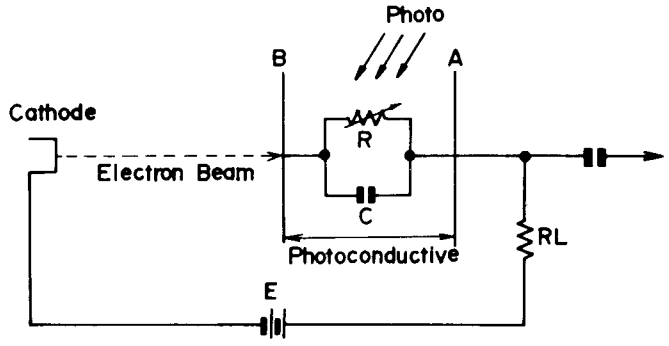
Vidicon is operated as follows:

The equivalent circuit of Vidicon can be shown as figure 2.

"A" in the figure 2 indicates "SIGNAL ELECTRODE" (Transparent conductive film) and "B" indicates the PHOTOCONDUCTIVE plane facing to the electron gun. Consequently, the space between "A" and "B" shows PHOTOCONDUCTIVE film, on which the optical image is made in focus. The photoconductive film is varied its conductivity in proportion to the intensity of incident light according to light intensity of each part of the object. That is, it has high resistance at dark part and decreases its resistance where more light is got. Accordingly, the optical image consisting of intensity of light on the photoconductive film is transfered into the distributed image of electric resistance.

When the positive potential "E" against the cathode (called TERGET VOLTAGE in general, 20–40 V) is applied between A and B through the LOAD RESISTANCE (RL) and scanning electron beam is reached to "B", the electric potential on the "B" plane becomes equal to that of cathode, then electric charge is stored at capacitor "C".

Next, when the electron beam leaves, the electric charge stored at capacitor "C" will be discharged through resistor "R" and electric potential of "B" will become close to that of "A". The condition of changing potential is decided by TIME CONSTANT of capacitor "C" and resistor "R". Therefore, the lower resistance part exposed by light has bigger potential increase because of its lower resistance, on the contrary, the higher resistance part by no light has smaller potential increase. The relation of this is shown in Figure 3.



Equivalent Circuit of Vidicon

Figure 3

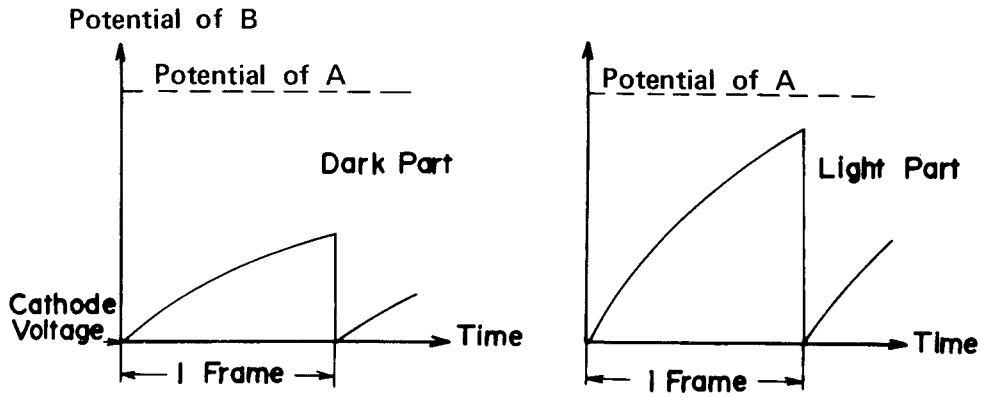


Figure 4

LOCK DIAGRAM

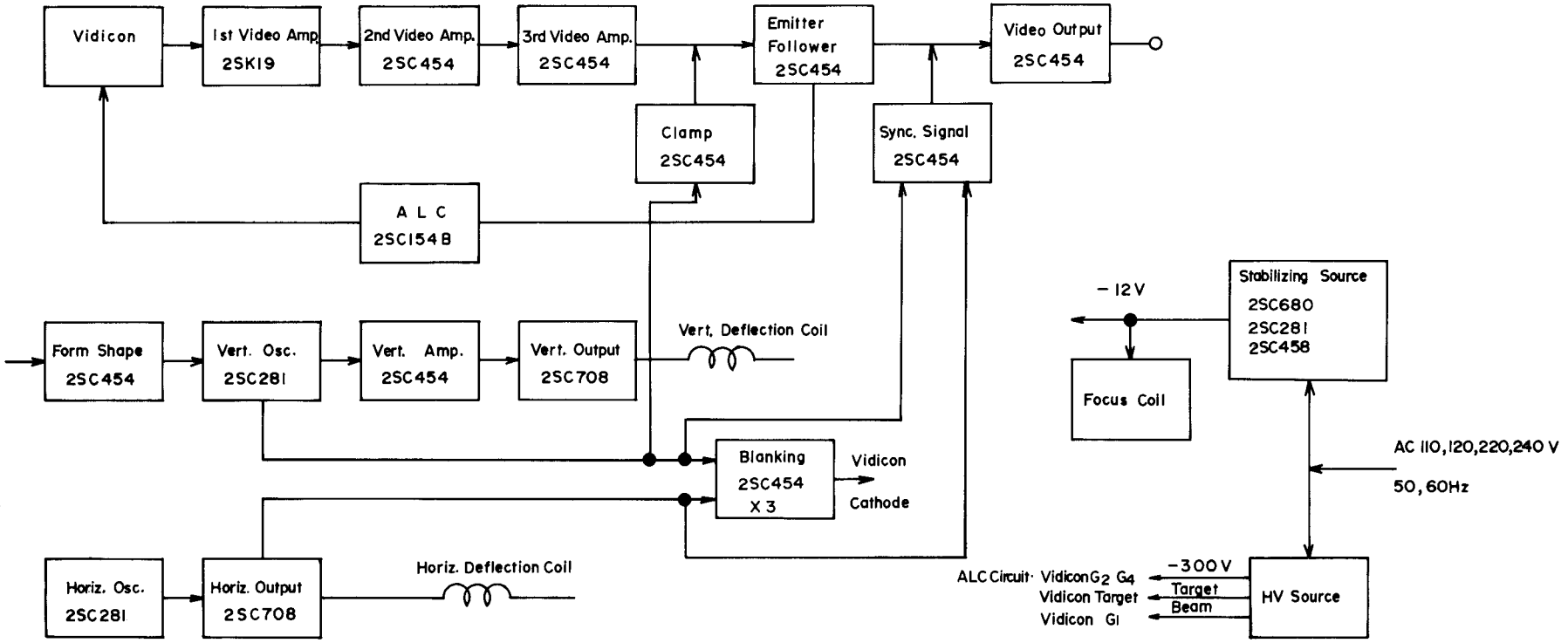


Figure 5

CIRCUIT DESCRIPTION

1. Video Amplifier Circuit

Video signal produced from the target of vidicon is fed into Q101. This IT-31CZ uses Q101, so-called JUNCTION TYPE FIELD EFFECT TRANSISTOR (FET), which has high input impedance in order to get bigger video signal from the vidicon.

Control (R131) at the emitter side of Q102 serves to adjust frequency characteristics.

Image signals amplified by Q101, Q102 and Q103 are clamped by Q104 at a definite voltage for black level. Q105 is an emitter-follower to improve a clamping characteristic.

In the clamped image signal is inserted a synchronizing signal by Q106 and it enters into the output transistor Q107. Q107 is an emitter-follower to decrease output impedance.

Furthermore, the circuit with Q108 is a automatic sensitivity adjusting circuit by which image signal of Q105 emitter is changed into current voltage in accordance with the signal level and is fed back to the target of vidicon, thus obtaining proper image signal. That is, when the object is in the light and the image signal is strong, the target voltage is lowered to decreased the sensitivity of the vidicon.

When the object is in the dark, the sensitivity is increased to gain constant output.

Level Control (R132) at the emitter side of Q108 serves to adjust the target voltage.

2. Horizontal Deflection Circuit

The circuit with Q401 and T401 serves as a blocking oscillator that generates 15,750Hz pulse. Frequency is adjusted by H-Freq. Control (R321). Q402 is switched by the pulse from the blocking oscillator to run saw-tooth current to the horizontal deflection yoke. Pulse voltage at the collector of Q402 is used as clamping, synchronizing and blanking signals.

3. Vertical Deflection Circuit

The circuit with Q302 and T301 serves as a blocking oscillator which generates pulse synchronizing with the power source frequency with the trigger signal from Q301.

This pulse is made into saw tooth voltage by R308 and C304 and is amplified by Q303 and then runs saw-tooth current to the deflection yoke through the output transistor (Q304).

Pulse generating at the emitter of Q302 is used as synchronizing signal and blanking signal.

4. Blanking Circuit

Vertical pulse and horizontal pulse from deflection circuits enter into Q501 and Q502 bases, respectively. They are amplified and shaped and then mixed by Q503. Positive blanking signal generates at the collector of Q503 and it is added to the vidicon's cathode to execute blanking.

5. Power Circuit

The circuit with Q601, Q602 and Q603 is a constant voltage source circuit to supply +12V to other circuits. Q601 is a control transistor which controls the fluctuation of voltage due to alteration of power source voltage and load by regulating its internal resistance, thus keeping the voltage at +12V as set by the VOLT-ADJ Control (R610).

Q603 is as DC amplifier to detect the output voltage change.

SR605, SR606 and SR607 are Zener diodes of 300V, which supply stabilized voltage to each electrode of vidicons.

CONNECTIONS

1. When exclusive monitor is used with the camera output as video.
   A) Basic constitution (Camera and monitor, one each) ..... Refer to Fig. 6.
   Input impedance of monitor must be 75 ohm.
   B) When images of more than two cameras are caught by one monitor. (Refer to Fig. 7)
   In this case, connect the lines by using the image changeover device as shown in Fig. 8. That is, connect the input terminal and the output terminal of the image changeover device respectively to each camera and to the monitor with coaxial cables. Input impedance of the monitor is 75 ohm.
   C) When image of one camera is caught by more than two monitors.
      i) In case of bridge connection (Refer to Fig. 8)
      When the monitors are concentrated in a place or arranged in line as viewed from the camera, connect the monitors in bridge style with coaxial cables as shown in the figure 8. As a monitor is usually provided with two input terminals, use them for connecting the monitors. Set the input impedance at 75 ohm for the last monitor and keep it high for the others.
      ii) When an image distributor is used
      When the monitors are placed in more than two directions as viewed from the camera or many monitors are used, use image distributors for their connection as shown in Fig. 9 because good pictures will not be gained by bridge.
      An image distributor is a device that distributes the signal of a camera to many monitors. It is also possible to increase the distribution capacity by using more than two image distributors and to further increase the number of monitors through combination with bridge connection, as shown in Fig. 10.
   D) Remote Control (Refer to Fig. 11)
   When remotely controlling the power source ON/OFF switch, auto zoom lens and turning devices (IT-11RZ, IT-21RZ) from the monitor side, arrange the connections as shown in Fig. 11.

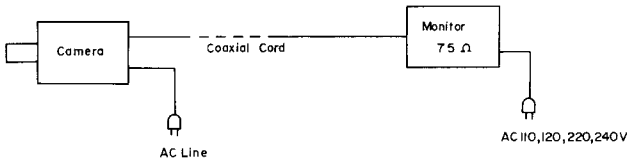


Figure 6

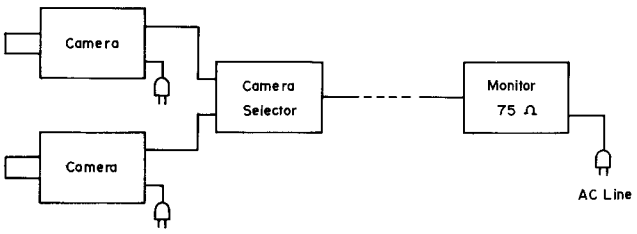


Figure 7

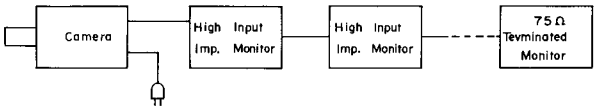


Figure 8

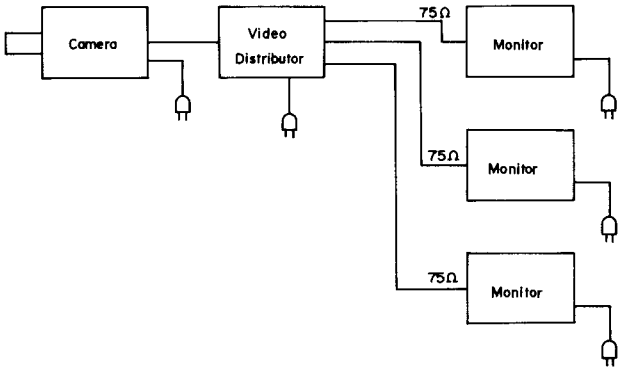


Figure 9

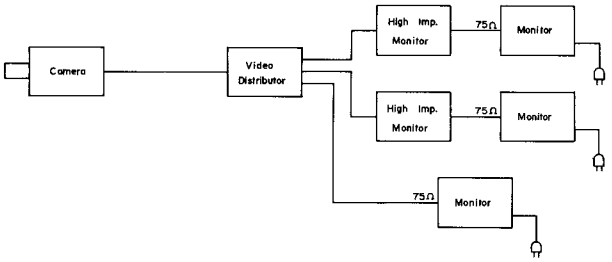


Figure 10

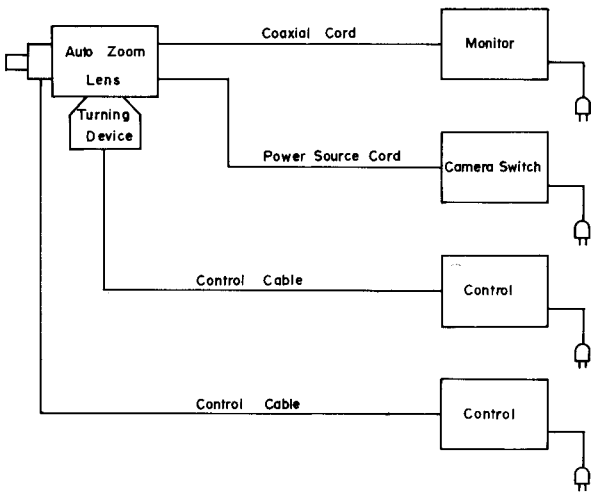


Figure 11

OPERATION

1) Preparation

Remove the cap of the lens and fix the camera on a tripod or a mount. Then connect the output terminal of the camera to the monitor by using coaxial cables. Connect the power source cord to a plug-in socket after checking the rated power source voltage and frequency of the camera.

2) Power Source Switch

First turn on the monitor switch to actuate the monitor and then switch on for the camera. The picture will appear in about 30 seconds.

3) Focus Beam

Adjust the lens focus and the focus control provided at the back of the camera so that the clearest picture can be gained. If the picture does not appear or it is not clear, adjust the beam control as follows.

Fully turn the beam control knob counterclockwise and then slowly turn it clockwise. The picture will then gradually appear from the dark.

Turn the beam control knob clockwise by 10° to 20° from the position of the best picture and then set it there. If the knob is turned clockwise excessively, resolution will worsen.

When the beam control is adjusted, the focus must also be re-adjusted.

4) CAUTIONS

(1) As ITV camera is precision apparatus, it must be handled with special care. When stored or operated, it must be free from strong shock, high temperatures or moisture, and vibration.
When the set is inevitably used in such a place, the camera housing exclusively provided must be used.

(2) If the set is used under magnetic condition or placed near magnet objects, the picture deflects or the resolution worsens.

(3) Exposing the picture to a strong light must be avoided. Image pick-up tubes will otherwise become defective due to burn-out. Therefore, do not face the picture to strong light sources such as sun light.

(4) When the lens is off, take care to protect the image pick-up tube from scratching or dust.

(5) Never carry the camera with the lens down nor give it shock. The image pick-up tube may otherwise be scratched on the photo-electric tube from inside.

(6) When no vertical synchronizing signal appears in the monitor, immediately turn off the switch and fully turn the beam control (R129) counterclockwise and check the circuits, because the vidicon may stop deflection. The photo-electric surface may otherwise burn out.

MAINTENANCE AND ADJUSTMENT

1. Removal of The Printed Circuit Board Assembly

Remove the PCB set-screws and take it out and check, taking care not break the leads.

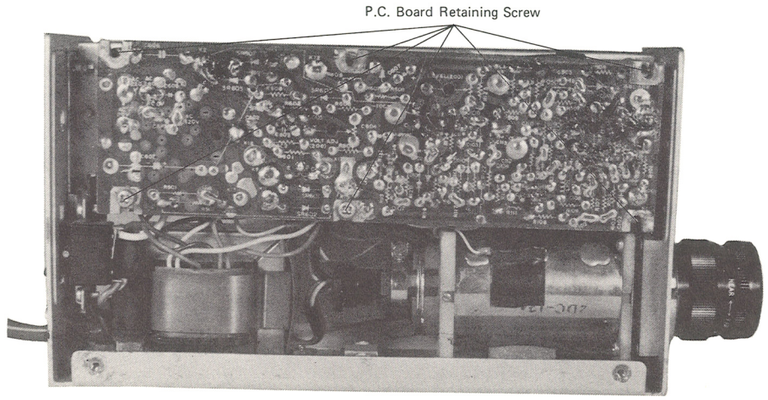


Figure 12

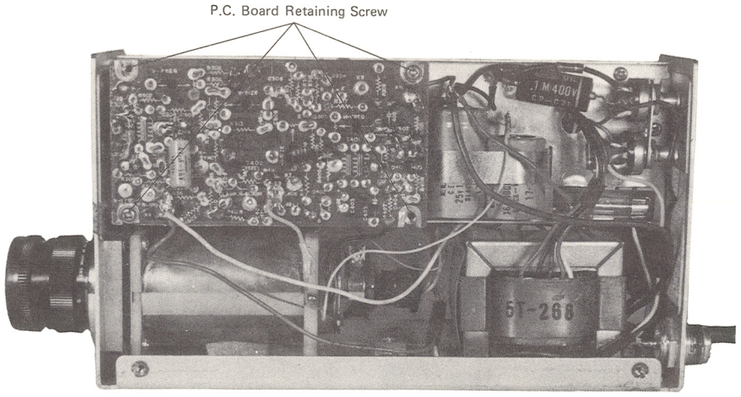


Figure 13

2. Replacement of Vidicon

Vidicon is a consumption goods and it may be lowered in sensitivity or worsen in producing quality pictures in several thousands hours operation.

When a strong light is taken, the vidicon surface may be burn out, worsening the picture. In such a case, replace the vidicon in the following manners.

i) Turn off the power supply switch for the camera and disconnect the AC cord from the plug receptacle. Then remove the set-screws at four corners of the camera and take off the cover.

ii) Loosen the band fixing the vidicon and remove the socket to take off the lens, and then the vidicon can be taken out from the front.

iii) Insert a new vidicon and the socket. When inserting the face plate of vidicon, use a soft cloth like deer skin so as not to scratch the vidicon surface.

iv) Mount the lens and turn on the power source switch to get the picture in the monitor.
Adjust the focus ring of lens to infinity and set the focus to a remote object by moving the vidicon. At the time, also adjust the focus control (R130) to obtain the best picture.

3. Focusing Coil and Deflection Coil

If the lens cannot be properly focused, adjust it by moving the vidicon.

If the picture is inclined, adjust the deflection coil, loosening the two set-screws fixing the coil frame.

When fixing it, tighten up the set-screws, fully inserting the coil frame. Two alignment magnets are used for the adjustment but they must be left untouched except when the vidicon is exchanged.

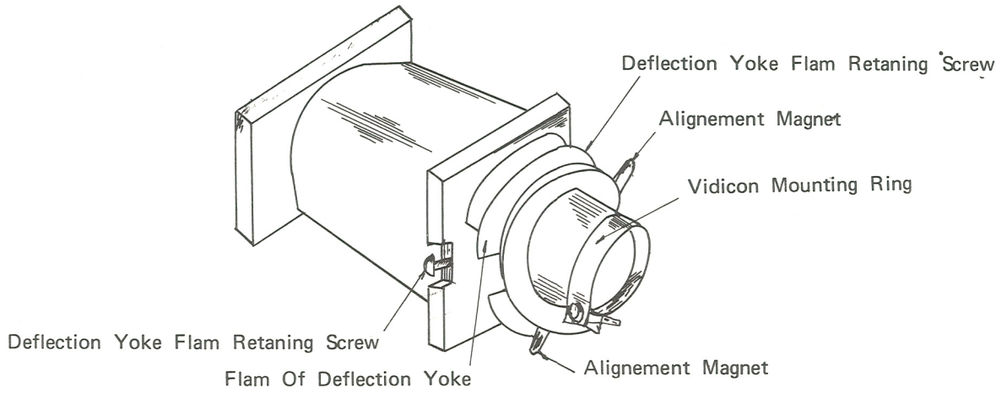


Figure 14

4. Power Source Fuse

The fuses are provided at the back and left-hand side of the camera and they are of glass tube type of 0.2A (220/240V) or 0.4A (110V/120V).

5. Adjustment of Power Source Voltage (+12V)

Set the output voltage at +12V by adjusting the voltage adjust control (R610) provided on the image board.

6. Horizontal Scanning Frequency

Adjust the frequency to 15,750Hz by the horizontal frequency control (R321) provided on the deflection board.

7. H-Size & V-Size Adjustment

Turning these controls clockwise will reduce the horizontal and vertical amplitudes and enlarge the picture in the monitor. For the easy adjustment, turn the controls clockwise a little from the position where the white target ring disappears from the four corners of the picture and set the knobs there.

8. Vertical Frequency Adjustment

Fully turn the V-Freq. Control (R319) clockwise. Then slowly turn it counterclockwise and set it at the point 45° to 60° from the position where it is just synchronized.

9. Level Adjustment

This is used for sensitivity adjustment. Turning the level control knob clockwise will increase the sensitivity and sharpen the contrast and turning it counterclockwise will decrease the sensitivity. Set the knob properly in accordance with the conditions of the object to be pictured.

10. H.P. Adjustment (R131)

This is used for high speaker adjustment.

Turning the control knob clockwise will appear the black shadow around the object and turning it counterclockwise will appear the white shadow around the object.

Set the knob at the point where it is just disappear these shadows.

11. Beam Adjustment (R129)

Rotate this control knob counterclockwise and set the point just disappear the white part of object. And then rotate it clockwise and set it at the point 10°~20° from the position where it is best picture at the white part of object.

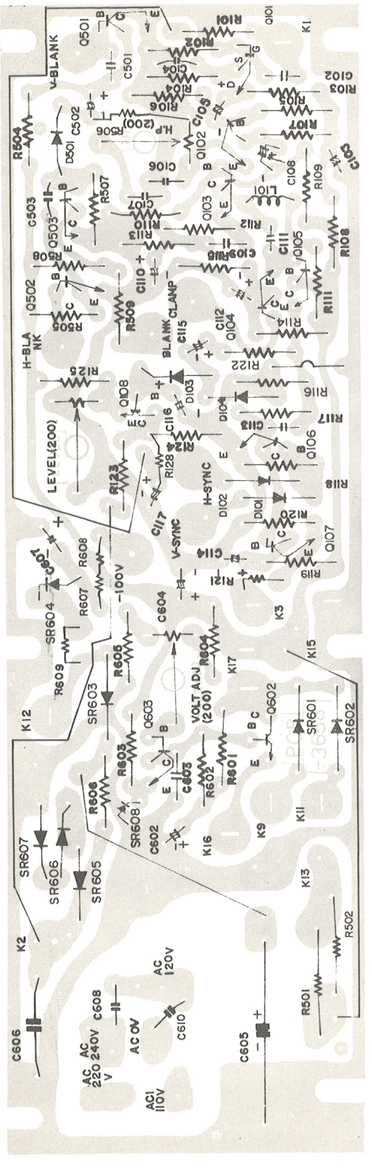


Figure 16

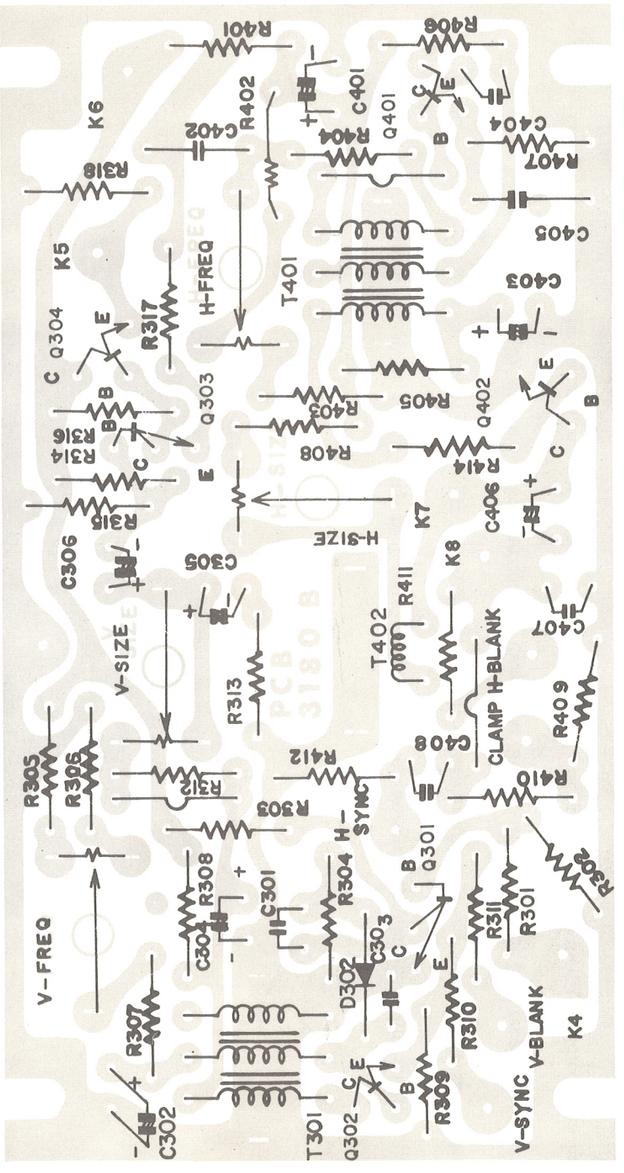


Figure 17

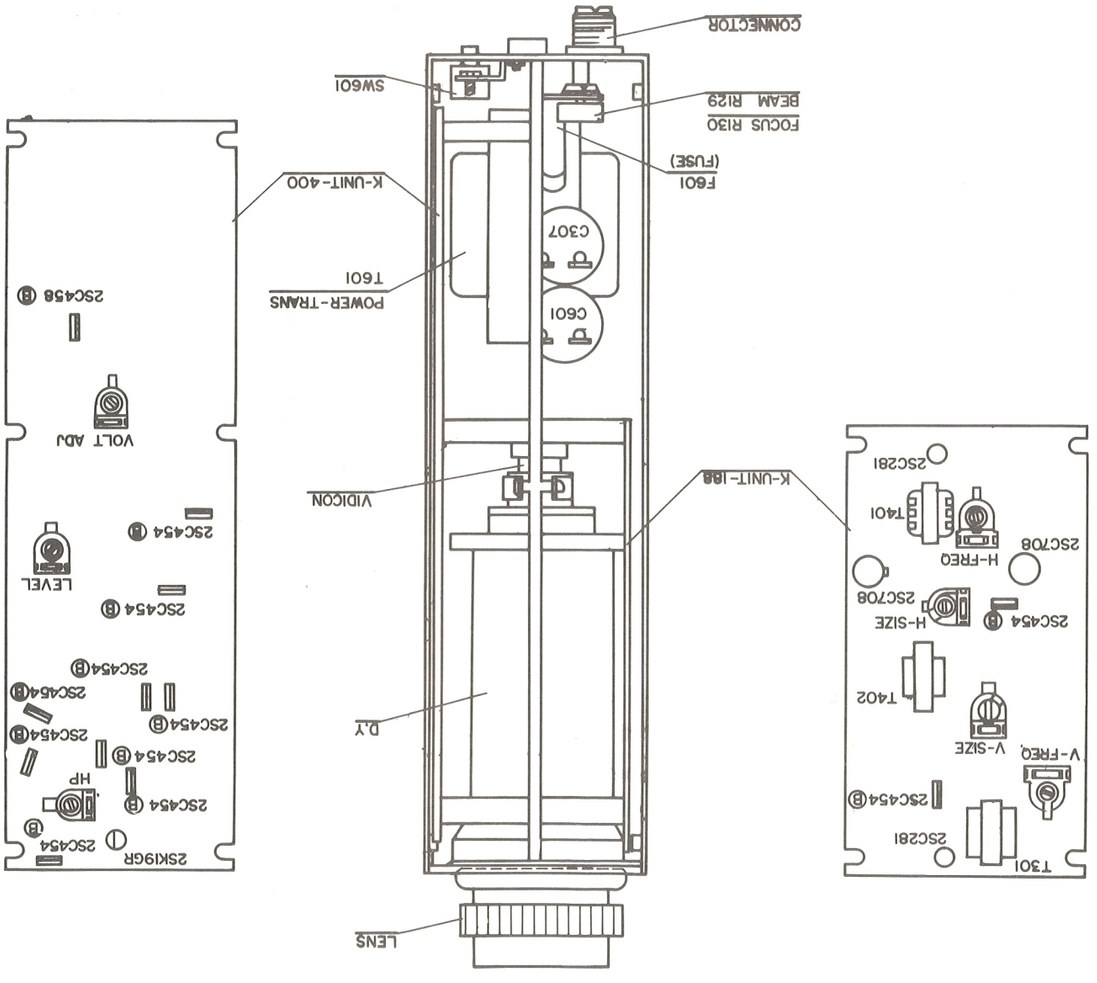


Figure 15

CHASSIS LAYOUT

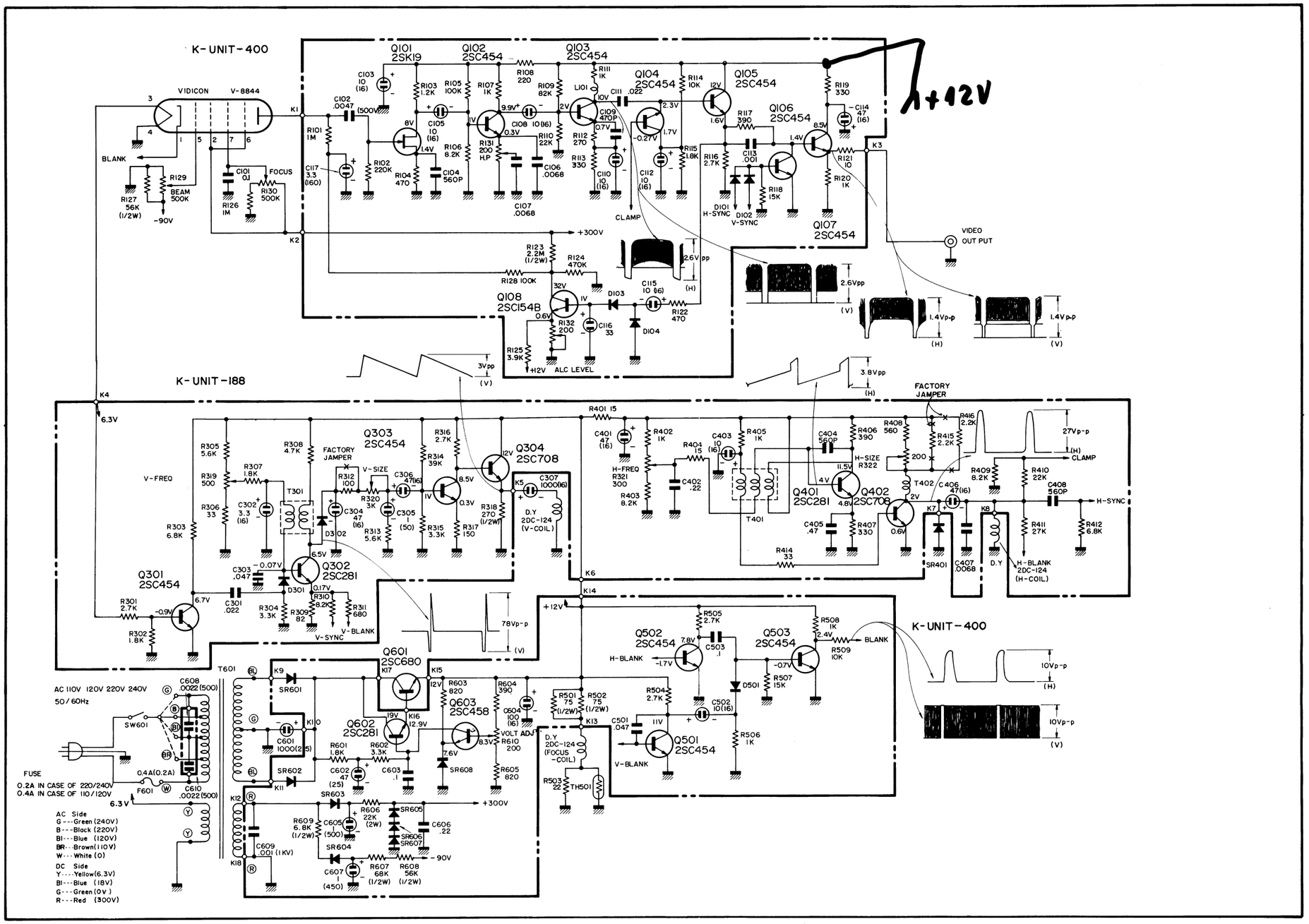


Figure 18 Schematic Diagram

REF. NO.	DESCRIPTION	PART NAME
	CAPASITOR	
C101	.1MFD, 400V, 20%, Oil	OL-40-104M
C102	.0047MFD, 500V, Discap	D-50-476P
C103, C105, C108, C110, C112, C115	10MFD, 16V, Electrolytic	CU1.6-102Q
C104	560PF, 50V, 10%, Discap	D-5-567K
C106, C107	.0068MFD, 50V, 10%, Discap	D-5-686K
C109	470PF, 50V, 10%, Discap	D-5-477K
C111	.022MFD, 50V, 10%, Mylar	ML-5-225K
C113	.001MFD, 50V, 10%, Mylar	ML-5-106K
C114	47MFD, 16V, Electrolytic	CU1.6-472Q
C116	33MFD, 25V, Electrolytic	CU2.5-332Q
C117	3.3MFD, 160V, Electrolytic	CU-16-333R
C301	.022MFD, 50V, 10%, Mylar	ML-5-225K
C302	3.3MFD, 16V, Aluminium Electrolytic	AC1.6-333
C303	.047MFD, 50V, 10%, Mylar	ML-5-475K
C304	47MFD, 16V, Electrolytic	TL1.6-472M
C305	1MFD, 50V, Electrolytic	CU-5-103R
C306	47MFD, 16V, Electrolytic	CU1.6-472Q
C307	1000MFD, 16V, Electrolytic	1.6L-1000Q
C401, C406	47MFD, 16V, Electrolytic	CU1.6-472Q
C402	.22MFD, 50V, 10%, Mylar	ML-5-224K
C403	10MFD, 16V, Electrolytic	CU1.6-102Q
C404, C408	560PF, 50V, 10%, Discap	D-5-567K
C405	.47MFD, 50V, 10%, Mylar	ML-5-474K
C407	.0068MFD, 50V, 10%, Mylar	ML-5-686K
C501	.047MFD, 50V, 10%, Mylar	ML-5-475K
C502	10MFD, 16V, Electrolytic	CU1.6-102Q
C503	.1MFD, 50V, 10%, Mylar	ML-5-104K
C601	1000MFD, 25V, Electrolytic	2.5L-1000Q
C602	47MFD, 25V, Electrolytic	CU2.5-472Q
C603	.1MFD, 50V, 10%, Mylar	ML-5-104K
C604	100MFD, 16V, Electrolytic	CU1.6-101Q
C605	1MFD, 500V, Electrolytic	CT-50-103Q
C606	.22MFD, 400V, 10%, Metallized Film	MF-40-224K
C607	1MFD, 450V, Electrolytic	CU-45-103X
C608, C610	.0022MFD, 500V, 10%, Discap	D-50-226K
C609	.001MFD, 10KV, 10%, Discap	D-1K-106K

	RESISTOR	
R101	1Meg ohm, 1/2W, 10%, Carbon	1/2M-1MK
R102	220K ohm	1/4M-220KK
R103	1.2K ohm	1/4M-1.2KK
R104, R122	470 ohm	1/4M-470K
R105, R128	100K ohm	1/4M-100KK
R106	8.2K ohm	1/4M-8.2KK
R107, R111, R120	1K ohm	1/4M-1KK
R108	220 ohm	1/4M-220K
R109	82K ohm	1/4M-82KK
R110	22K ohm	1/4M-22KK
R112	270 ohm	1/4M-270K
R113, R119	330 ohm	1/4M-330K
R114	10K ohm	1/4M-10KK
R115	1.8K ohm	1/4M-1.8KK
R116	2.7K ohm	1/4M-2.7KK
R117	390 ohm	1/4M-390K
R118	15K ohm	1/4M-15KK
R121	10 ohm	1/4M-10K
R123	2.2 ohm, 1/2W, 20%, Carbon	1/2M-2.2M
R124	470K ohm	1/4M-470KK
R125	3.9K ohm	1/4M-3.9KK
R126	1Meg ohm, 1/2W, 10%, Carbon	1/2M-1MK
R127	56K ohm, 1/2W, 10%, Carbon	1/2M-56KK
R301, R316	2.7K ohm	1/4M-2.7KK
R302, R307	1.8K ohm	1/4M-1.8KK
R303	6.8K ohm	1/4M-6.8KK
R304, R315	3.3K ohm	1/4M-3.3KK
R305, R313	5.6K ohm	1/4M-5.6KK
R306	33 ohm	1/4M-33K
R308	4.7K ohm	1/4M-4.7KK
R309	82 ohm	1/4M-82K
R310	8.2K ohm	1/4M-8.2KK
R311	680 ohm	1/4M-680K
R312	100 ohm	1/4M-100K
R314	39K ohm	1/4M-39KK
R317	150 ohm	1/4M-150K
R318	270 ohm, 1/2W, 10%, Carbon	1/2M-270K
R401, R404	15 ohm	1/4M-15K
R402	1K ohm, 1/4W, 5%, Carbon	1/4M-1KJ
R403	8.2K ohm, 1/4W, 5%, Carbon	1/4M-8.2KJ
R405	1K ohm	1/4M-1KK
R406	390 ohm	1/4M-390K
R407	330 ohm, 1/4W, 5%, Carbon	1/4M-330J
R408	560 ohm	1/4M-560K
R409	8.2K ohm	1/4M-8.2KK
R410	22K ohm	1/4M-22KK
R411	27K ohm	1/4M-27KK
R412	6.8K ohm	1/4M-6.8KK
R414	33 ohm	1/4M-33K
R415, R416	2.2K ohm	1/4M-2.2KK
R501, R502	75 ohm, 1/2W, 10%, Carbon	1/2M-75K
R503	22 ohm	1/4M-22K
R504, R505	2.7K ohm	1/4M-2.7KK
R506, R508	1K ohm	1/4M-1KK
R507	15K ohm	1/4M-15KK
R509	10K ohm	1/4M-10KK
R601	1.8K ohm	1/4M-1.8KK
R602	3.3K ohm	1/4M-3.3KK
R603, R605	820 ohm	1/4M-820K
R604	390 ohm	1/4M-390K
R606	22 ohm, 2W, 10%, Oxide Film	2PO-22K
R607	68K ohm, 1/2W, 10%, Carbon	1/2M-68KK
R608	56K ohm, 1/2W, 10%, Carbon	1/2M-56KK
R609	6.8K ohm, 1/2W, 10%, Carbon	1/2M-6.8KK

Unless otherwise specified all resistors are 1/4W, 10%, Carbon type.

	CONTROLS	
R129, R130	500K ohm, Pot., Beam, Focus	9V-004
R131, R132	200 ohm, Pot., H.P, ALC	9V-008
R319	500 ohm, Pot., V-Freq.	9V-014
R320	3K ohm, Pot., V-Size	9V-010
R321	300 ohm, Pot., H-Freq.	9V-074
R322	200 ohm, Pot., H-Size	9V-008
R610	200 ohm, Pot., Voltage Adjust	9V-008

REF.NO.	DESCRIPTION	PART NAME
	COILS AND TRANSFORMERS	
L101	Coil, Peaking	CL-470
T301	Transformer, Vertical Oscillation	9T-223
T401	Transformer, Horizontal Oscillation	9T-180
T402	Transformer, Horizontal Output	9T-264
T601	Transformer, Power	5T-268
	MISCELLANEOUS	
	Printed Circuit Board Assembly	K-UNIT-400
	Printed Circuit Board Assembly	K-UNIT-188
	Cover, Camera	9CAB-3180A
	Cabinet, Body	X9CAB-3658B
	Socket, Camera Side	CONCENT218
	Switch, AC	8S-90
	Socket,	SO-654
	Yoke, Vidicon	2DC-124
	Cord, AC	ACC-29
	Fuse, 0.2A	FS0.2A-X

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